

## WHAT IS CLAIMED IS:

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C2  
1. A method of providing monotonic sequence numbers in a highly available manner, comprising the steps of:

- 5 (a) establishing a primary sequence number generator;
- (b) establishing a secondary sequence number generator;
- (c) generating a sequence number request at an originating node;
- (d) forwarding the sequence number request to the primary sequence number generator;
- 10 (e) forwarding a sequence number response to the secondary sequence number generator;
- (f) storing the sequence number response at the secondary sequence number generator; and
- (g) forwarding the response sequence number from the secondary sequence number generator to the originating node;

15 wherein logical operations associated with steps (d) - (g) are implemented in at least one selection from the list of:

hardware; and

firmware.

20 2. The method of claim 1, wherein step (c) comprises the sub-steps of:

performing a sequence number request call by a software process operating upon a host processor system to a user-space function; and

executing a sequence number request via an interface located at the originating node.

3. The method of claim 2 further comprising the step of:  
receiving the sequence number response at the interface; and  
communicating the sequence number response to the software process.

5 4. The method of claim 3, wherein the software process executes a spin loop  
while waiting to receive the sequence number response.

Q 5. The method of claim 4, wherein the software process is placed into a sleep  
state if the sequence number response is not received within a predetermined amount of time.

6. The method of claim 2, wherein the interface is a hardware card linked to a  
sequence number fabric.

10 7. The method of claim 6, wherein the host processor system comprises a second  
hardware card linked to a duplicate sequence number fabric.

8. The method of claim 1, wherein the primary and secondary sequence number  
generators store current sequence numbers in memory associated with respective host  
processor systems via direct memory access operations.

15 9. The method of claim 3, wherein the hardware card pipelines a plurality of  
sequence number requests.

10. A highly available sequence number generation system for providing monotonic sequence numbers with minimal latency, comprising:

a plurality of sequence number devices, connected via a fabric, including at least a primary sequence number generator and a secondary sequence number generator;

the primary sequence number generator disposed to receive sequence number request from an originating device and to forward sequence number response to the secondary sequence number generator;

the secondary sequence number generator disposed to receive the sequence number response, store the sequence number response in memory, and forward the response to the originating device.

11. The system of claim 10, wherein each device includes lower level sequence number routines accessible by software processes operating on a host processor system via user-space functions.

12. The system of claim 11, wherein the user-space functions includes a request new sequence number function.

13. The system of claim 12, wherein the request new sequence number function causes a requesting application process to execute a spin loop while waiting for receipt of a new sequence number.

14. The system of claim 13, wherein the requesting application process is placed in a sleep state if the new sequence number is not received within a predetermined amount of time.

15. The system of claim 10, wherein the primary and secondary sequence number generators store current sequence numbers in memory associated with respective host processor systems via direct memory access operations.

16. The system of claim 10, wherein the sequence number request is associated with a pipeline of sequence number requests from the originating device.

17. The system of claim 11, wherein each host processor system comprises a second sequence number device, thereby defining a duplicate fabric.

18. A method for recovery from a sequence number generation failure in a system comprising a plurality of sequence number devices, comprising the steps of:

detecting that a primary sequence number generator is unavailable;

5 selecting a first replacement sequence number generator for the primary sequence number generator;

selecting a second replacement sequence number generator for a secondary sequence number generator;

communicating a current sequence number; and

10 communicating to each available device of the plurality of sequence number devices identifiers of the first and second replacement sequence number generators.

19. The method of claim 18, wherein the current sequence number is determined by retrieving a stored sequence number.

20. The method of claim 18, wherein the current sequence number is determined by utilizing a seed operation.

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